1 1. A navigation system for a set of materials, comprising:

2   a plurality of attributes characterizing the materials;

3   a plurality of values describing the materials, wherein each of the values

4 has an association with at least one of the attributes and each association defines an

5 attribute-value pair, and wherein some of the attribute-value pairs refine other of the

6 attribute-value pairs;

7   a plurality of navigation states, wherein each navigation state corresponds

8 to a particular expression of attribute-value pairs and to a particular subset of the

9 materials; and

10   an interface, the interface providing a plurality of transitions, each transition

11 providing a direct path between two of the navigation states, wherein each transition

12 represents a change from the expression of attribute-value pairs corresponding to an

13 originating navigation state to the expression of attribute-value pairs corresponding to a

14 destination navigation state, wherein a series of one or more transitions provides a path

15 between any two navigation states, there being more than one path between at least a first

16 of the navigation states and a second of the navigation states.

17 2. The navigation system of claim 1, wherein at least one navigation state

18 corresponds to an expression of attribute-value pairs that relates at least one attribute-

19 value pair conjunctively.

20 3. The navigation system of claim 1, wherein at least one navigation state

21 corresponds to an expression of attribute-value pairs that relates at least one attribute-

22 value pair disjunctively.

1   4.   The navigation system of claim 1, wherein at least one navigation state

2   corresponds to an expression of attribute-value pairs that relates at least one attribute-

3   value pair negationally.

4   5.   The navigation system of claim 1, wherein at least one of the transitions

5   from an originating navigation state to a destination navigation state represents a

6   refinement of the value of one of the attribute-value pairs in the corresponding expression

7   of attribute-value pairs for the originating navigation state.

8   6.   The navigation system of claim 1, wherein at least one of the transitions

9   from an originating navigation state to a destination navigation state represents a

10   generalization of the value of one of the attribute-value pairs in the corresponding

11   expression of attribute-value pairs for the originating navigation state.

12   7.   The navigation system of claim 1, wherein at least one of the transitions

13   from an originating navigation state to a destination navigation state represents a

14   deselection of the attribute of one of the attribute-value pairs in the corresponding

15   expression of attribute-value pairs for the originating navigation state.

16   8.   The navigation system of claim 1, wherein a first of the transitions from an

17   originating navigation state to a first destination navigation state represents a selection of

18   an attribute-value pair corresponding to a first attribute and a second of the transitions

19   from the originating navigation state to a second destination navigation state represents a

20   selection of an attribute-value pair corresponding to a second attribute.

21   9.   The navigation system of claim 1, wherein at least one of the transitions

22   from an originating navigation state to a destination navigation state represents a

1   selection of an attribute-value pair corresponding to an attribute for which there is no

2   corresponding attribute-value pair in the expression of attribute-value pairs corresponding

3   to the originating navigation state.

4   10.   The navigation system of claim 1, wherein at least one of the transitions

5   from an originating navigation state to a destination navigation state represents

6   disjunctive relation of an attribute-value pair to the expression of attribute-value pairs for

7   the originating navigation state.

8   11.   The navigation system of claim 1, wherein at least one of the transitions

9   from an originating navigation state to a destination navigation state represents negational

10   relation of an attribute-value pair to the expression of attribute-value pairs for the

11   originating navigation state.

12   12.   The navigation system of claim 1, wherein an originating navigation state

13   corresponds to one of the materials in the set of materials, at least one of the transitions

14   from the originating navigation state to a destination navigation state representing a

15   selection of a particular attribute-value pair associated with the originating navigation

16   state.

17   13.   The navigation system of claim 1, wherein the values associated with at

18   least one of the plurality of attributes are defined explicitly.

19   14.   The navigation system of claim 1, wherein the values associated with at

20   least one of the plurality of attributes are defined implicitly.

1   15.   The navigation system of claim 1, wherein, for attribute-value pairs

2   sharing a common attribute, no attribute-value pair refines a plurality of mutually

3   incomparable attribute-value pairs.

4   16.   The navigation system of claim 1, wherein, for attribute-value pairs

5   sharing a common attribute, at least one attribute-value pair refines a plurality of

6   mutually incomparable attribute-value pairs.

7   17.   The navigation system of claim 1, wherein no attribute-value pair refines a

8   plurality of mutually incomparable attribute-value pairs.

9   18.   The navigation system of claim 1, wherein at least one attribute-value pair

10   refines a plurality of mutually incomparable attribute-value pairs.

11   19.   The navigation system of claim 1, wherein, for any two attribute-value

12   pairs corresponding to different attributes, the two attribute-value pairs are incomparable.

13   20.   The navigation system of claim 1, wherein the set of materials includes

14   materials related to a single subject area.

15   21.   The navigation system of claim 1, wherein the set of materials includes

16   materials related to a plurality of subject areas.

17   22.   The navigation system of claim 1, wherein the set of materials includes a

18   subset of the materials, the subset being integrally navigable, a portion of the materials in

19   the set of materials being assigned to the subset.

20   23.   The navigation system of claim 22, wherein the interface is

21   adapted to provide a plurality of transitions related to the subset of materials.

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1   24.   The navigation system of claim 22, wherein the set of materials includes a

2   plurality of subsets, each of the plurality of subsets being independently integrally

3   navigable, a portion of the materials in the set of materials being assigned to each subset,

4   at least one of the materials being assigned to more than one subset.

5   25.   The navigation system of claim 1, further including a profile for each of

6   the materials in the set of materials, the profile including a set of attribute-value pairs.

7   26.   The navigation system of claim 25, the profile further including

8   descriptive information.

9   27.   The navigation system of claim 1, the interface including a human user

10   interface.

11   28.   The navigation system of claim 1, the interface including an applications

12   program interface.

13   29.   The navigation system of claim 1, wherein the interface is operable in a

14   World Wide Web-based environment.

15   30.   The navigation system of claim 1, wherein the interface is operable in an

16   XML-based environment.

17   31.   The navigation system of claim 1, wherein the interface supplements the

18   functionality of an independent data-oriented program.

19   32.   The navigation system of claim 1, the interface including a guided search

20   tool for enabling navigation from a current navigation state based on the plurality of

21   transitions among the plurality of navigation states.

1   33.   The navigation system of claim 32, the interface including a free-text

2   search tool for searching the attributes.

3   34.   The navigation system of claim 32, the interface including a free-text

4   search tool for searching the values.

5   35.   The navigation system of claim 32, further including a profile for each of

6   the materials in the set of materials, the profile including descriptive information, the

7   interface including a free-text search tool for searching the descriptive information in the

8   profiles.

9   36.   The navigation system of claim 32, the interface including access to the

10   materials in the set of materials.

11   37.   The navigation system of claim 32, the interface including a presentation

12   of attribute-value pairs corresponding to the current navigation state.

13   38.   The navigation state of claim 37, the presentation of attribute-value pairs

14   corresponding to the current navigation state including user-selected attribute-value pairs

15   and inferred attribute-value pairs, the interface including an indication of user-selected

16   attribute-value pairs and of inferred attribute-value pairs.

17   39.   The navigation system of claim 37, the presentation of attribute-value

18   pairs corresponding to the current navigation state including only mutually incomparable

19   attribute-value pairs.

20   40.   The navigation system of claim 37, wherein the presentation organizes the

21   attribute-value pairs corresponding to the current navigation state by attribute.

1   41.   The navigation system of claim 37, wherein the presentation organizes the

2   attribute-value pairs corresponding to the current navigation state by more general

3   attribute-value pairs.

4   42.   The navigation system of claim 32, the guided search tool including a

5   presentation of navigation options for selection from the current navigation state, the

6   options corresponding to transitions from the current navigation state.

7   43.   The navigation system of claim 42, the navigation options including

8   attribute-value pairs that are refinements of the attribute-value pairs corresponding to the

9   current navigation state.

10   44.   The navigation system of claim 43, wherein the options include a

11   presentation of a set of lists of attribute-value pairs, each list corresponding to one of the

12   attributes, some lists including attribute-value pairs that refine the attribute-value pairs

13   corresponding to the current navigation state and some lists including attribute-value

14   pairs that are incomparable to the attribute-value pairs corresponding to the current

15   navigation state.

16   45.   The navigation system of claim 42, the navigation options including

17   disjunctive selection of attribute-value pairs.

18   46.   The navigation system of claim 45, wherein the disjunctive selection

19   options include a second attribute-value pair that corresponds to an attribute for which a

20   first corresponding attribute-value has previously been selected, the second attribute-

21   value pair being mutually incomparable to the first.

1   47.   The navigation system of claim 42, the navigation options including

2   negational selection of attribute-value pairs.

3   48.   The navigation system of claim 42, wherein the presentation organizes the

4   navigation options by attribute.

5   49.   The navigation system of claim 42, wherein the presentation organizes the

6   navigation options by more general attribute-value pairs.

7   50.   The navigation system of claim 42, the navigation options including

8   attribute-value pairs that are incomparable to the attribute-value pairs corresponding to

9   the current navigation state.

10   51.   The navigation system of claim 42, the navigation options including

11   attribute-value pairs that are generalizations of the attribute-value pairs corresponding to

12   the current navigation state.

13   52.   The navigation system of claim 42, the navigation options including

14   deselection of attribute-value pairs from the expression of attribute-value pairs

15   corresponding to the current navigation state.

16   53.   The navigation system of claim 42, the navigation options further

17   including a link to an associated navigation state.

18   54.   The navigation system of claim 53, wherein the associated navigation state

19   is a generalization of the present navigation state.

20   56. The navigation system of claim 53, wherein the associated navigation state is

21   a refinement of the present navigation state.

1   57.   The navigation system of claim 53, wherein the link corresponds to a path

2   of two or more transitions.

3   58.   A method for enabling a user to browse a set of materials, a plurality of

4   attributes characterizing the materials, a plurality of values describing the materials, each

5   of the values having an association with at least one of the attributes, each association

6   defining an attribute-value pair, some of the attribute-value pairs refining other of the

7   attribute-value pairs, comprising the steps of:

8   defining a plurality of navigation states, each navigation state

9   corresponding to a particular expression of attribute-value pairs and to a particular subset

10   of the materials;

11   providing an interface, the interface providing a plurality of transitions,

12   each transition providing a direct path between two of the navigation states, wherein each

13   transition represents a change from the expression of attribute-value pairs corresponding

14   to an originating navigation state to the expression of attribute-value pairs corresponding

15   to a destination navigation state, wherein a series of one or more transitions provides a

16   path between any two navigation states, there being more than one path between at least a

17   first of the navigation states and a second of the navigation states;

18   providing a display of transitions for selection;

19   accepting a selection of a transition;

20   obtaining a result navigation state associated with the selected transition;

21   and

1   providing a revised display of transitions in the result navigation state for

2   selection.

3   59.   The method of claim 58, wherein the step of providing a display of

4   transitions for selection includes at least one transition that corresponds to conjunctive

5   selection of an attribute-value pair.

6   60.   The method of claim 58, wherein the step of providing a display of

7   transitions for selection includes at least one transition that corresponds to disjunctive

8   selection of an attribute-value pair.

9   61.   The method of claim 58, wherein the step of providing a display of

10   transitions for selection includes at least one transition that corresponds to negational

11   selection of an attribute-value pair.

12   62.   The method of claim 58, wherein the step of providing a display of

13   transitions for selection includes providing a display of attribute-value pairs, wherein

14   attribute-value pairs in the display can be related by Boolean operators.

15   63.   The method of claim 62, wherein the step of providing a display includes

16   organizing the attribute-value pairs by attribute.

17   64.   The method of claim 58, wherein the step of accepting a selection of a

18   transition includes accepting a selection of an attribute-value pair.

19   65.   The method of claim 64, wherein the step of accepting the selection of an

20   attribute-value pair triggers the step of obtaining a result navigation state.

21   66.   The method of claim 58, wherein the step of providing a revised display of

22   transitions includes providing a display of a revised set of attribute-value pairs, wherein

1 attribute-value pairs in the revised set can be related by conjunction, disjunction, and

2 negation.

3   67.   The method of claim 66, wherein the step of providing a display of a

4 revised set of attribute-value pairs includes providing a display of, for the previously

5 selected attribute-value pair, a set of refining attribute-value pairs.

6   68.   The method of claim 66, wherein the step of providing a display of a

7 revised set of attribute-value pairs includes organizing the attribute-value pairs by more

8 general attribute-value pairs.

9   69.   The method of claim 66, wherein the step of providing a revised display

10 includes adding an attribute previously unrepresented in the display.

11   70.   The method of claim 58, further including the steps of accepting an

12 additional selected attribute-value pair and obtaining an additional result navigation state

13 associated with the selected attribute-value pair and the additional selected attribute-value

14 pair.

15   71.   The method of claim 70, wherein the additional selected attribute-value

16 pair is associated with a different attribute than the selected attribute-value pair.

17   72.   The method of claim 58, further including the step of displaying a list of

18 previously selected attribute-value pairs.

19   73.   The method of claim 72, further including the steps of accepting the

20 deselection of a selected attribute-value pair and obtaining a revised result navigation

21 state.

1   74. A method for enabling a user to browse a set of materials, a plurality of

2   attributes characterizing the materials, a plurality of values describing the materials, each

3   of the values having an association with at least one of the attributes, each association

4   defining an attribute-value pair, some of the attribute-value pairs refining other of the

5   attribute-value pairs, a plurality of navigation states, each navigation state corresponding

6   to an expression of particular attribute-value pairs and to a particular subset of materials,

7   an interface providing a plurality of transitions, each transition providing a direct path

8   between two of the navigation states, wherein each transition represents a change from

9   the expression of attribute-value pairs corresponding to an originating navigation state to

10   the expression of attribute-value pairs corresponding to a destination navigation state,

11   wherein a series of one or more transitions provides a path between any two navigation

12   states, there being more than one path between at least a first of the navigation states and

13   a second of the navigation states, comprising the steps of:

14   displaying a free-text search box;

15   accepting a search term entered in the free-text search box;

16   determining the attribute-value pairs that match the search term;

17   displaying the matching attribute-value pairs for the search term;

18   accepting a selection of a matching attribute-value pair; and

19   entering a navigation state having a corresponding expression that relates

20   to the selection of the matching attribute-value pair.

21   75. A method for providing an information navigation system, the information

22   navigation system including a set of materials, a plurality of attributes characterizing the

1   materials, a plurality of values describing the materials, each of the values having an

2   association with at least one of the attributes, each association defining an attribute-value

3   pair, some of the attribute-value pairs refining other of the attribute-value pairs, a

4   plurality of navigation states, each navigation state corresponding to a particular

5   expression of attribute-value pairs and to a particular subset of the materials, comprising

6   the steps of:

7   computing the navigation states;

8   storing the navigation states in a data structure;

9   providing an interface to the information navigation system, the interface

10   providing a plurality of transitions, each transition providing a direct path between two of

11   the navigation states, wherein each transition represents a change from the expression of

12   attribute-value pairs corresponding to an originating navigation state to the expression of

13   attribute-value pairs corresponding to a destination navigation state, wherein a series of

14   one or more transitions provides a path between any two navigation states, there being

15   more than one path between at least a first of the navigation states and a second of the

16   navigation states;

17   accepting a query to the navigation system; and

18   returning a responsive navigation state by retrieving a responsive pre-

19   computed navigation state or computing a responsive navigation state.

20   76.   The method of claim 75, wherein the data structure is a graph data

21   structure including nodes and edges between nodes, the nodes representing navigation

22   states, the edges representing transitions.

1   77.   A method of providing an information navigation system, the information

2 navigation system including a set of materials, a plurality of attributes characterizing the

3 materials, a plurality of values describing the materials, each of the values having an

4 association with at least one of the attributes, each association defining an attribute-value

5 pair, some of the attribute-value pairs refining other of the attribute-value pairs, a

6 plurality of navigation states, each navigation state corresponding to a particular

7 expression of attribute-value pairs and to a particular subset of the materials, comprising

8 the steps of:

9   generating a partial set of pre-computed navigation states;

10   storing the partial set of pre-computed navigation states;

11   providing an interface to the information navigation system, the interface

12 providing a plurality of transitions, each transition providing a direct path between two of

13 the navigation states, wherein each transition represents a change from the expression of

14 attribute-value pairs corresponding to an originating navigation to the expression of

15 attribute-value pairs corresponding to a destination navigation state, wherein a series of

16 one or more transitions provides a path between any two navigation states, there being

17 more than one path between at least a first of the navigation states and a second of the

18 navigation states;

19   accepting a query to the navigation system; and

20   returning a responsive navigation state by retrieving a responsive pre-

21 computed navigation state or computing a responsive navigation state.

1   78.   The method of claim 77, wherein the step of returning a responsive

2   navigation state includes returning a navigation state computed by a plurality of servers

3   acting in parallel.

4   79.   The method of claim 78, further including the step of partitioning the

5   materials among the plurality of servers.

6   80.   The method of claim 79, wherein the plurality of servers are nested

7   hierarchically.

8   81.   The method of claim 80, wherein a root server of the plurality of servers

9   acts as a master server and some of the plurality of servers act as slave servers, further

10   including the steps of the master server distributing a request for a navigation state on to a

11   plurality of slave servers, the slave servers computing navigation states for those requests

12   and returning the results to the master server, and the master server combining the results

13   from the slave servers to obtain a navigation state corresponding to the request.

14   82.   The method of claim 81, wherein the combining step includes computing

15   least common ancestors of attribute-value pairs corresponding to the navigation states

16   returned by the slave servers.

17   83.   A method of providing an information navigation system, the information

18   navigation system including a set of materials, a plurality of attributes characterizing the

19   materials, a plurality of values describing the materials, each of the values having an

20   association with at least one of the attributes, each association defining an attribute-value

21   pair, some of the attribute-value pairs refining other of the attribute-value pairs, a

22   plurality of navigation states, each navigation state corresponding to a particular

1   expression of attribute-value pairs and to a particular subset of the materials, comprising

2   the steps of:

3   storing the navigation states in an implicit representation;

4   providing an interface to the navigation system, the interface providing a

5   plurality of transitions, each transition providing a direct path between two of the

6   navigation states, wherein each transition represents a change from the expression of

7   attribute-value pairs corresponding to an originating navigation state to the expression of

8   attribute-value pairs corresponding to a destination navigation state, wherein a series of

9   one or more transitions provides a path between any two navigation states, there being

10   more than one path between at least a first of the navigation states and a second of the

11   navigation states;

12   accepting a query to the navigation system;

13   generating a responsive navigation state from the implicit representation;

14   and

15   presenting the responsive navigation state.

16   84.   The method of claim 83, wherein the step of generating a responsive

17   navigation state includes computing a responsive navigation state using a plurality of

18   servers acting in parallel.

19   85.   The method of claim 84, further including the step of partitioning the

20   materials among the plurality of servers.

21   86.   The method of claim 85, wherein the plurality of servers are nested

22   hierarchically.

1   87.   The method of claim 86, wherein a root server of the plurality of servers

2   acts as a master server and some of the plurality of servers act as slave servers, further

3   including the steps of the master server distributing a request for a navigation state on to a

4   plurality of slave servers, the slave servers computing navigation states for those requests

5   and returning the results to the master server, and the master server combining the results

6   from the slave servers to obtain a navigation state corresponding to the request.

7   88.   The method of claim 87, wherein the combining step includes the

8   computation of least common ancestors of attribute-value pairs corresponding to the

9   navigation states returned by the slave servers.

10   89.   The method of claim 83, further including the step of storing the

11   responsive navigation state in a cache.

12   90.   A method for profiling a user of a navigation system, comprising the steps

13   of:

14   providing a navigation system, the navigation system including a set of

15   materials, a plurality of attributes characterizing the materials, a plurality of values

16   describing the materials, each of the values having an association with at least one of the

17   attributes, each association defining an attribute-value pair, some of the attribute-value

18   pairs refining other of the attribute-value pairs, a plurality of navigation states, each

19   navigation state corresponding to a particular expression of attribute-value pairs and to a

20   particular subset of the materials, and an interface providing a plurality of transitions,

21   each transition providing a direct path between two of the navigation states, wherein each

22   transition represent a change from the expression of attribute-value pairs corresponding

1   to an originating navigation state, wherein a series of one or more transitions provides a

2   path between any two navigation states, there being more than one path between at least a

3   first of the navigation states and a second of the navigation states, the transitions being

4   selectable by attribute-value pairs;

5   accepting the user's selection of attribute-value pairs to navigate through

6   the plurality of navigation states; and

7   tracking the user's selection of attribute-value pairs.

8   91.   The method of claim 90, further including the step of developing a user

9   profile based on the user's selection of attribute-value pairs.

10   92.   The method of claim 91, wherein the step of developing a user profile

11   further includes the step of supplementing the user profile based on the attribute-value

12   pairs corresponding to the navigation states visited by the user.

13   93.   A computer program product, residing on a computer readable medium,

14   for use in navigating a set of materials, in which the materials are characterized by a

15   plurality of attributes, and the materials are described by a plurality of values, each of the

16   values having an association with at least one of the attributes, each association defining

17   an attribute-value pair, some of the attribute-value pairs refining other of the attribute-

18   value pairs, the computer program product comprising instructions for causing a

19   computer to:

20   define a plurality of navigation states, each navigation state corresponding to a

21   particular expression of attribute-value pairs and to a particular subset of the materials;

1   provide an interface, the interface providing a plurality of transitions, each

2   transition providing a direct path between two of the navigation states, wherein each

3   transition represents a change from the expression of attribute-value pairs corresponding

4   to an originating navigation state to the expression of attribute-value pairs corresponding

5   to a destination navigation state, wherein a series of one or more transitions provides a

6   path between any two navigation states, there being more than one path between at least a

7   first of the navigation states and a second of the navigation states;

8   accept a selection of a transition; and

9   provide a result navigation state associated with the selected transition.

10